

CLAIMS

What is claimed is:

1. Method of detecting a fire in a scene by infrared radiation image processing, said method comprising the steps of:

receiving a sequential plurality of infrared radiation images of the scene, each said image including an array of picture elements (pixels), each pixel having a value that is representative of the pixel's portion of infrared radiation intensity in the array of the scene image;

identifying a region of at least one pixel in one image of the plurality of images of the scene based on pixel values;

tracking said region through images of the plurality subsequent said one image to determine a change of said region that meets predetermined infrared radiation criteria; and

detecting the fire in the scene based on the determined change of said region.

2. The method of claim 1 wherein the step of identifying includes the steps of:

determining a threshold value from the values of the pixels of the one image; and

identifying the region by comparing the values of the pixels of the one image to the determined threshold value.

3. The method of claim 2 including the step of assigning pixels having values above the threshold value and in close proximity to each other in the one image array to the region.

4. The method of claim 2 wherein the step of determining a threshold value includes the steps of: calculating a mean value of the pixel values of the one image; and determining the threshold value based on the calculated mean value.

5. The method of claim 2 wherein the step of determining a threshold value includes the steps of: calculating a standard deviation value of the pixel values of the one image; and determining the threshold value based on the calculated standard deviation value.

6. The method of claim 1 wherein the step of tracking includes the steps of:

identifying the region in images of the plurality subsequent the one image; and

comparing the identified regions of the one and subsequent images to determine a change of the region that meets the predetermined infrared radiation criteria.

7. The method of claim 6 wherein the step of comparing includes the step of comparing the identified regions of the one and subsequent images to determine the change of the region that meets the predetermined infrared radiation criteria based on the average pixel values of the region.

8. The method of claim 6 wherein the step of comparing includes the step of comparing the identified regions of the one and subsequent images to determine the change of the region that meets the predetermined infrared radiation criteria based on the number of pixel values in the region that are above a high intensity value.

9. The method of claim 6 wherein the step of comparing includes the step of comparing the identified regions of the one and subsequent images to determine the change of the region that meets the predetermined infrared radiation criteria based on a location of the centroid of the region within the image scene.

10. The method of claim 6 wherein the one and subsequent images are separated from each other by a predetermined period of time.

11. The method of claim 6 wherein the one and subsequent images are separated from each other by a predetermined number of sequential images of the plurality.

12. The method of claim 1 including the step of locating the fire in the scene based on the location of the region with the determined change in the scene.

13. The method of claim 1 wherein the step of detecting the fire includes the steps of:

identifying the region in sequential images of a predetermined period of time subsequent the one image;

comparing the identified regions of the one and sequential images to determine motion changes of the region;

calculating a motion value of the region based on said determined motion changes thereof; and

determining fire of a certain type based on the motion value of the region.

14. The method of claim 13 including the step of determining a flaming fire if the motion value exceeds a predetermined threshold motion value.

15. The method of claim 13 including the step of determining a smoldering fire if the motion value is below a predetermined threshold motion value.

16. The method of claim 13 including the step of issuing an alarm based on the type of fire determined.

17. The method of claim 1 including the step of displaying the sequential plurality of infrared radiation images on a gray scale video monitor.

18. The method of claim 1 including the steps of:

identifying a plurality of regions of at least one pixel in one image of the plurality of images of the scene based on pixel values;

tracking each region of said plurality through images of the plurality subsequent said one image to determine at least one region of the plurality having a change that meets predetermined infrared radiation criteria; and

detecting the fire in the scene based on the at least one region having the determined change.

19. The method of claim 18 including the step of locating fires in the scene based on the locations of the regions with the determined change in the scene.

20. The method of claim 18 wherein the step of detecting the fire includes the steps of:

calculating a motion value for each region, said motion value being calculated based on motion changes of the corresponding region through a predetermined number of sequential images subsequent the one image; and

determining fire of a certain type for each region having the detected change based on the motion value of the region.